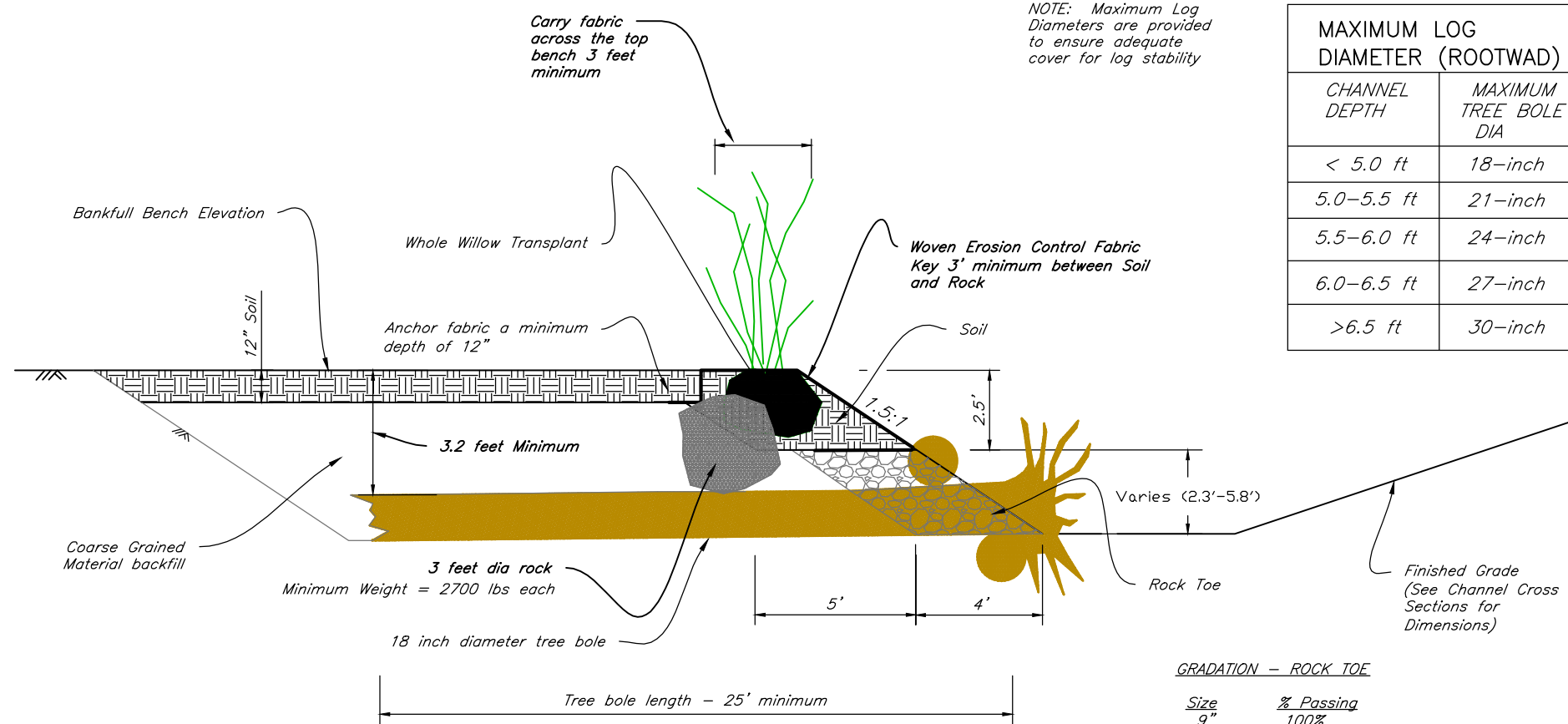


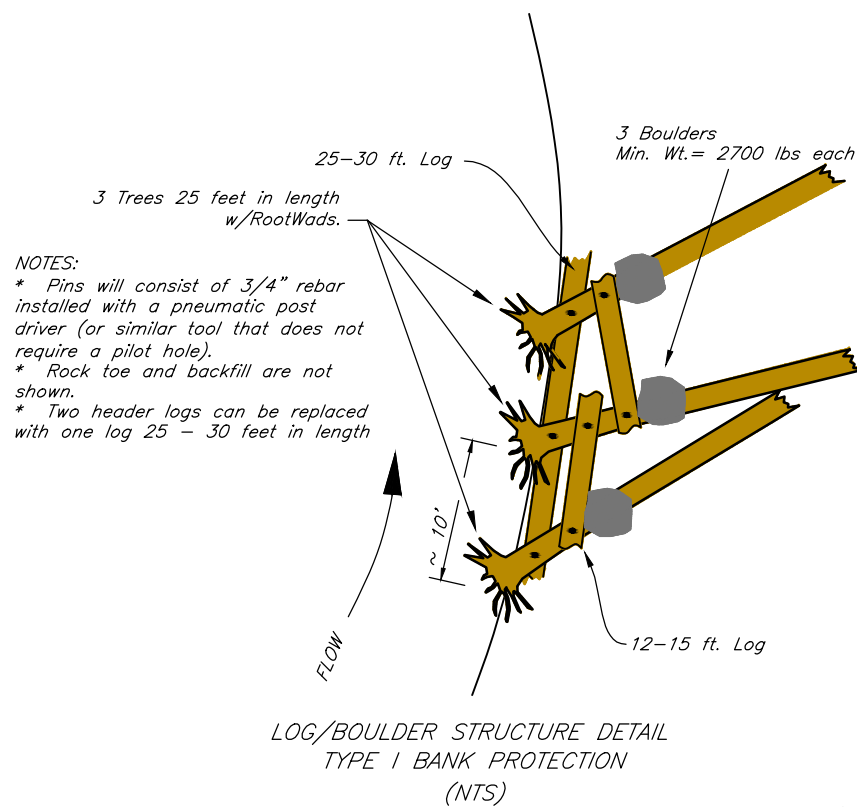
TYPICAL MEANDER PLAN VIEW WITH BANK TREATMENT 1 (NTS)



TYPICAL SECTION (MEANDER RIGHT) (NTS)

GRADATION - ROCK TOE

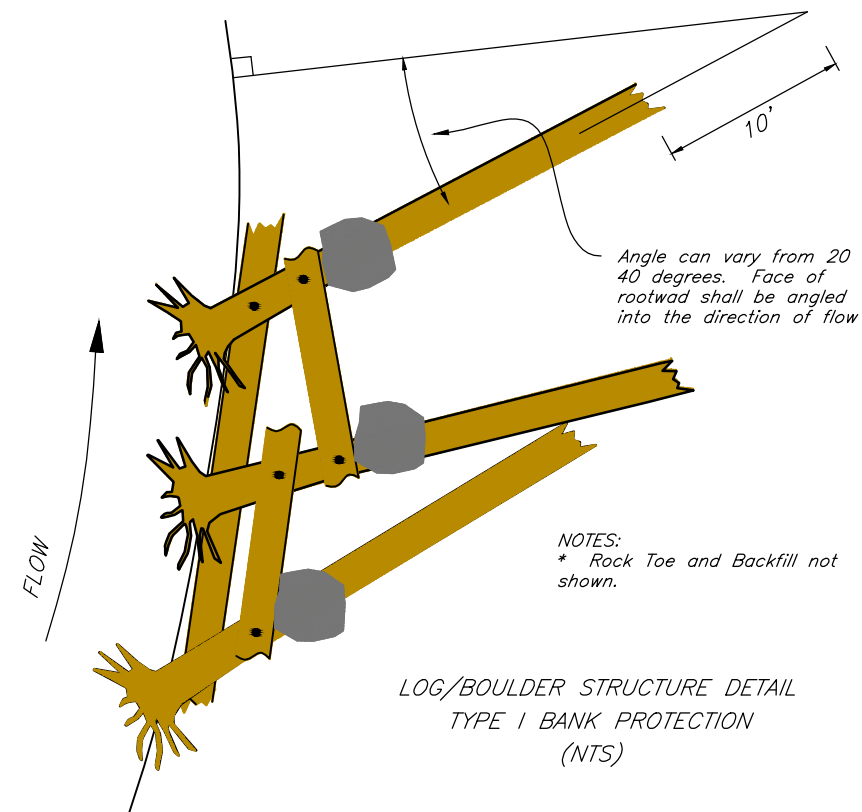
Size	% Passing
9"	100%
6.75"	60-100
4.5"	35-50
2.25"	10-35
1.25"	0-25



LOG/BOULDER STRUCTURE DETAIL TYPE I BANK PROTECTION (NTS)

TYPE I BANK PROTECTION REACH LOCATION							
DNSTREAM CL STA.*	UPSTREAM CL STA.*	NO. OF STR.S	NO. OF WILLOW CLUMPS	NO. OF ROOTWADS	LENGTH HEADERS FOOTERS	NO. OF Boulder	TON
101+25 R	101+95 R	2 1/3	7	7	140	7	9.4
102+90 L	103+08 L	3	9	9	180	9	12.2
107+85 R	108+60 R	2 2/3	8	8	160	8	10.8
110+54 R	111+55 R	3 1/3	10	10	200	10	13.5
113+42 L	114+40 L	3 1/3	10	10	200	10	13.5
116+64 L	117+59 L	3 1/3	10	10	200	10	13.5
119+61 R	120+60 R	3 1/3	10	10	200	10	13.5
123+17 R	123+70 R	2	6	6	120	6	8.1
126+73 L	127+49 L	2 2/3	8	8	160	8	10.8
130+72 L	131+52 L	2 2/3	8	8	160	8	10.8
132+15 R	132+57 R	1 2/3	5	5	100	5	6.8

*NOTE: "L" or "R" on Stations denote Left Bank or Right Bank location when looking downstream.



LOG/BOULDER STRUCTURE DETAIL TYPE I BANK PROTECTION (NTS)

Date	7/2015
Designed	K Hoffman
Drawn	K Hoffman
Checked	S.Becker
Approved	7/15

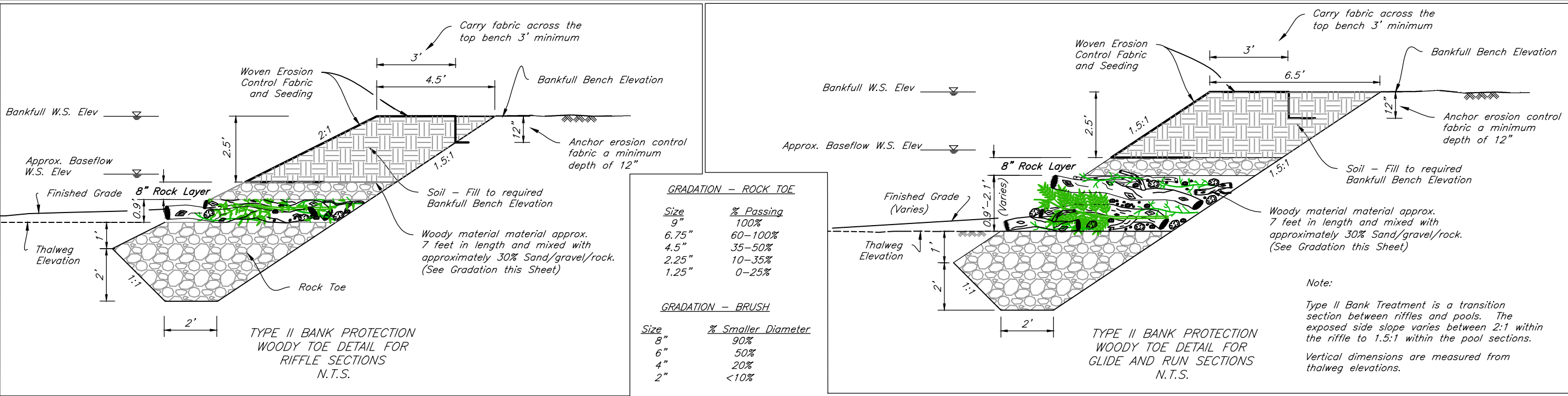
BANK PROTECTION DETAILS - TYPE I
BIG SPRING CREEK RESTORATION PROJECT
MACHLER, ADAMS And MT FISH WILDLIFE & PARKS
FERGUS COUNTY MONTANA



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GRADATION – ROCK TOE	
Size	% Passing
9"	100%
6.75"	60–100%
4.5"	35–50%
2.25"	10–35%
1.25"	0–25%

GRADATION – BRUSH	
Size	% Smaller Diameter
8"	90%
6"	50%
4"	20%
2"	<10%

Note:
Type II Bank Treatment is a transition section between riffles and pools. The exposed side slope varies between 2:1 within the riffle to 1.5:1 within the pool sections.
Vertical dimensions are measured from thalweg elevations.

BANK PROTECTION CONSTRUCTION NOTES

TYPE I BANK PROTECTION – LOG BOULDER

Materials:

- Trees to be utilized for bank protection shall be Douglas Fir or Ponderosa Pine in sound condition and without substantial defects. Bole diameter at breast height (4.5 ft above ground level) will be 18 to 30 inches. Rootwads shall be at least 4 feet in diameter. The NRCS Inspector will approve the trees onsite prior to the commencement of hauling.
- Header and Footer logs shall be 18 inches (+/- 6 inches) in diameter throughout their length.
- It is the responsibility of the Contractor to harvest the trees, with rootwads and limbs largely intact, and deliver them to the project site without damage.
- Trees will be topped at a diameter of 8", and limbed, to produce material to be utilized for Type II bank protection. Carefully stockpile limbs and tops at the project site to ensure full utilization of the material.
- Pinned connections will consist of 3/4" rebar, with a minimum length of 8" longer than the combined diameter of logs members to be connected.
- Boulders to be utilized for ballast will have a minimum weight of 2700 pounds each. Typical boulder size for this weight would be 3 to 3.5 foot median diameter where the least dimension is at least half of the maximum dimension.
- Woven Erosion Control Fabric shall meet or exceed specifications for Belton GeoCoir 900.
- Each Type I structure will require 3 willow clump transplants. Clumps will be 8' to 15' in height and approximate the width of the backhoe bucket. Refer to NRCS Idaho Technical Note 42, Willow Clump Plantings for details regarding harvest and transplanting.

Installation:

- The NRCS Inspector will stake locations of Type I bank protection structures.
- Pin logs together as shown utilizing 3/4" rebar and a pneumatic post driver. Following placement of rebar, cut end off 8–12" above the top of the log, and bend over to be flush with log.
- Place ballast boulders over logs, ensuring they are placed behind the header logs and in good contact with the lower logs.
- Toe rock of the same gradation used in the Type II and III Bank Treatments shall be placed to a 4 foot horizontal thickness on the bank face around the rootwads, headers, and to within 2.5 feet of the floodplain surface.
- Woven erosion control material shall be keyed a minimum of 3 feet between the soil fill and rock material.
- Soil material shall be seeded in accordance with Riparian Area Seed/Planting Plan (MT 342 JS1) prior to placement of the woven erosion control fabric.

TYPE II BANK PROTECTION – WOODY TOE

- The NRCS Inspector will stake the locations of Type II Bank Treatment.
- Rock shall be be graded as shown and is the same gradation as used for Bank Treatments I and III.
- Woody toe material shall be comprised of limbs, tree tops, and brush meeting the size criteria noted above. Limbs, tops, root materials from trees utilized for Type I bank protection and on-site cleared woodys are acceptable.
- Woody toe material shall be placed and pressed into place with a backhoe bucket to assure a dense compact section. Temporary weighting may be required to hold material in place while backfilling. Any weighting components shall be removed prior to bank completion.
- Coarse grained material of sufficient quantity shall be mixed/washed into the woody toe material to fill the voids. This quantity is ESTIMATED at 30% by volume of the space designated for woody material.
- An 8" layer of graded toe rock shall be placed above the woody toe material prior to soil placement.
- Woven erosion control fabric shall meet or exceed specifications for Belton Geocoir 900.
- Woven erosion control fabric shall be keyed a minimum of 3 feet between the soil fill and rock material.
- Soil material shall be seeded in accordance with Riparian Area Seeding/Planting Plan (MT 342–JS1) prior to placement of the woven erosion control fabric.
- Vertical Dimensions are measured from thalweg elevations.

TYPE II BANK PROTECTION REACH LOCATION	
DNSTREAM CL STA.*	UPSTREAM CL STA.*
102+25 L	102+91 L
107+20 R	107+84 R
108+60 R	109+15 R
110+30 R	110+54 R
111+54 R	112+10 R
112+80 L	113+42 L
116+10 L	116+64 L
117+59 L	118+19 L
119+20 R	119+61 R
120+60 R	121+20 R
123+70 R	124+10 R
127+49 L	127+79 L
129+80 L	130+72 L
131+52 L	132+02 L
132+57 R	132+82 R

*NOTE: "L" or "R" on Stations denote Left Bank or Right Bank location when looking downstream.

Date7/2015

DesignedK Hoffman

DrawnD Baker

CheckedS.Becker

Approved

BANK PROTECTION DETAILS – TYPE II

BIG SPRING CREEK RESTORATION PROJECT

MACHLER, ADAMS And MT FISH WILDLIFE & PARKS

FERGUS COUNTY

MONTANA

United States Department of Agriculture

USDA

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3/4" to 1" diameter, 5.5-6' long, 5 cuttings per lineal feet per lift. Cuttings shall extend back to the sloped bank and shall be placed on top of 2" of soil and covered with a firm layer of soil 2" thick prior to the construction of soil lift #1 as per soil lift detail shown on sheet 7 (See Riparian Forest Buffer Job Sheet MT-391).

Bankfull W.S. Elev.

Approx. Baseflow W.S. Elev.

Finished Grade (Varies)

Thalweg Elevation

Bankfull Bench Elevation

Soil - Fill to required Bankfull Bench Elevation

Soil Lifts - 12 inches thick

2"x4"x24" Wedge Stakes @ 3' c-c. Top and Bottom Soil Mats.

Round off Top Edge of Rock for Willow Placement.

Rock Toe

1.5:1

1.5:1

1.5:1

2.0'

1.0'

7.2'

4-5"

2.5'

1'

1'

Varies (~4.6'-4.0')

1'

2'

1' min

TYPE III BANK PROTECTION
DIMENSION DETAILS FOR SOIL LIFTS
POOLS, RUNS, GLIDES
N.T.S.

Bankfull Bench Elevation

Seed Top of Bench and Exposed Surfaces of Soil Lifts According to Critical Area Planting (MT Spec 342)

Soil - Fill to Required Bankfull Bench Elevation

Willows Cuttings

Woven Erosion Control Fabric (outer layer)

3 Layer Folded non-woven fabric

3 Layer Folded non-woven fabric

non-woven fabric (inner layer)

non-woven fabric (inner layer)

2" Soil Above Willows

Willows Cuttings

2" Soil Below Willows

2" Soil Above Willows

2" Soil Below Willows

Double Layer of Non-Woven Erosion Control Fabric on Top of Rock Toe

SOIL LIFT CONSTRUCTION DETAILS
N.T.S.

3/4" to 1" diameter, 5.5-6' long, 5 cuttings per lineal feet per lift. Cuttings shall extend back to the sloped bank and shall be placed on top of 2" of soil and covered with a firm layer of soil 2" thick prior to the construction of soil lift #1 as per soil lift detail shown on sheet 7 (See Riparian Forest Buffer Job Sheet MT-391).

and covered with a firm layer of soil 2" thick prior to the construction of soil lift #1 as per soil lift detail shown on sheet 7 (See Riparian Forest Buffer Job Sheet MT-391).

Bankfull W.S. Elev

Approx. Baseflow W.S. Elev

Finished Grade (Varies)

Thalweg Elevation

4-5"

3'

7.2'

Bankfull Bench Elevation

2.5'

1'

1'

1.6'

0.7'

2.3'

2'

1.5:1

1.5:1

Soil Lifts - 12 inches thick

1' min

2"x4"x24" Wedge Stakes @ 3' c-c. Top and Bottom Soil Mats.

Round off Top Edge of Rock for Willow Placement.

Rock Toe

GRADATION - ROCK TOE

* Vertical dimensions are measured from the thalweg elevation

TYPE III BANK PROTECTION
DIMENSION DETAILS FOR SOIL LIFTS
RIFFLES
N.T.S.

<i>DNSTREAM</i> CL STA.*	<i>UPSTREAM</i> CL STA.*
104+43 R	105+58 R
105+87 L	106+98 L
109+15 L	110+26 L
121+20 L	122+35 L
122+35 R	122+92 R
123+03 R	123+17 R
124+52 L	125+82 L
128+05 R	129+58 R

CONSTRUCTION NOTES

1. *The Engineer shall inspect and approve the rock toe prior to the construction of the soil lifts.*
2. *Woven erosion control fabric shall be used for the outer fabric layer of the soil wraps. It shall meet or exceed specifications for Belton Geocoir 900. Non-woven erosion control fabric shall be used for the inner fabric layer and meet or exceed specifications for Tensar North American Green C125BN.*
3. *All Erosion Control Fabric shall be rolled out in the direction of streamflow. Overlap the ends of each blanket at least three (3) feet longitudinally from upstream to downstream.*
4. *A double layer of non-woven fabric shall be placed on top of the rock toe followed by 2" of soil and willow cuttings. An additional 2" of soil shall be placed over the willow cuttings before constructing the next soil lift.*
5. *The rounded end of the soil lift shall be reinforced with three (3) additional layers of the non-woven erosion control fabric. Reinforcement material may be folded and shall have a finished width of 3 feet. Place as shown on the drawings.*
6. *Sufficient slack shall be provided to allow for surface irregularities when placing the inner and outer layers of fabrics.*
7. *Anchor each soil lift in place with 2x4-inch by 24 inch long wedge stakes spaced 3 feet c-c.*
8. *overlap the fabric a minimum of 18" when fabric joining is needed. Stake each seam at 2 foot intervals or the manufacturer's recommendations, whichever is smaller.*
9. *Soil lifts and fill shall be seeded in accordance with Riparian Area Seed/Planting Plan (MT 342 JS1) prior to wrapping and covering with fabric.*

CONSTRUCTION NOTES

Designed	<i>K Hoffman</i>	Date 7/2015
Drawn	<i>D Baker</i>	7/2015
Checked	<i>S.Becker</i>	7/15
Approved		

BANK PROTECTION DETAILS – TYPE III
BIG SPRING CREEK RESTORATION PROJECT
MACHLER, ADAMS And MT FISH WILDLIFE & PARKS
FERGUS COUNTY MONTANA



United States
Department of
Agriculture

Natural Resources
Conservation Service

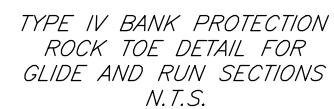
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<u>Size</u>	<u>% Passing</u>
9"	100%
6.75"	60-100
4.5"	35-50
2.25"	10-35
1.25"	0-25



Vertical dimensions are measured from thalweg elevation

<i>DNSTREAM</i> <i>CL STA.*</i>	<i>UPSTREAM</i> <i>CL STA.*</i>
100+89 R	101+25 R
101+95 R	102+25 R
103+80 L	104+24 L

**NOTE: "L" or "R" on Stations denote Left Bank or Right Bank location when looking downstream.*

BANK PROTECTION DETAILS – TYPE IV
BIG SPRING CREEK RESTORATION PROJECT
MACHLER, ADAMS And MT FISH WILDLIFE & PARKS

FERGUS COUNTY

United States
Department of
Agriculture

Natural Resources
Conservation Service

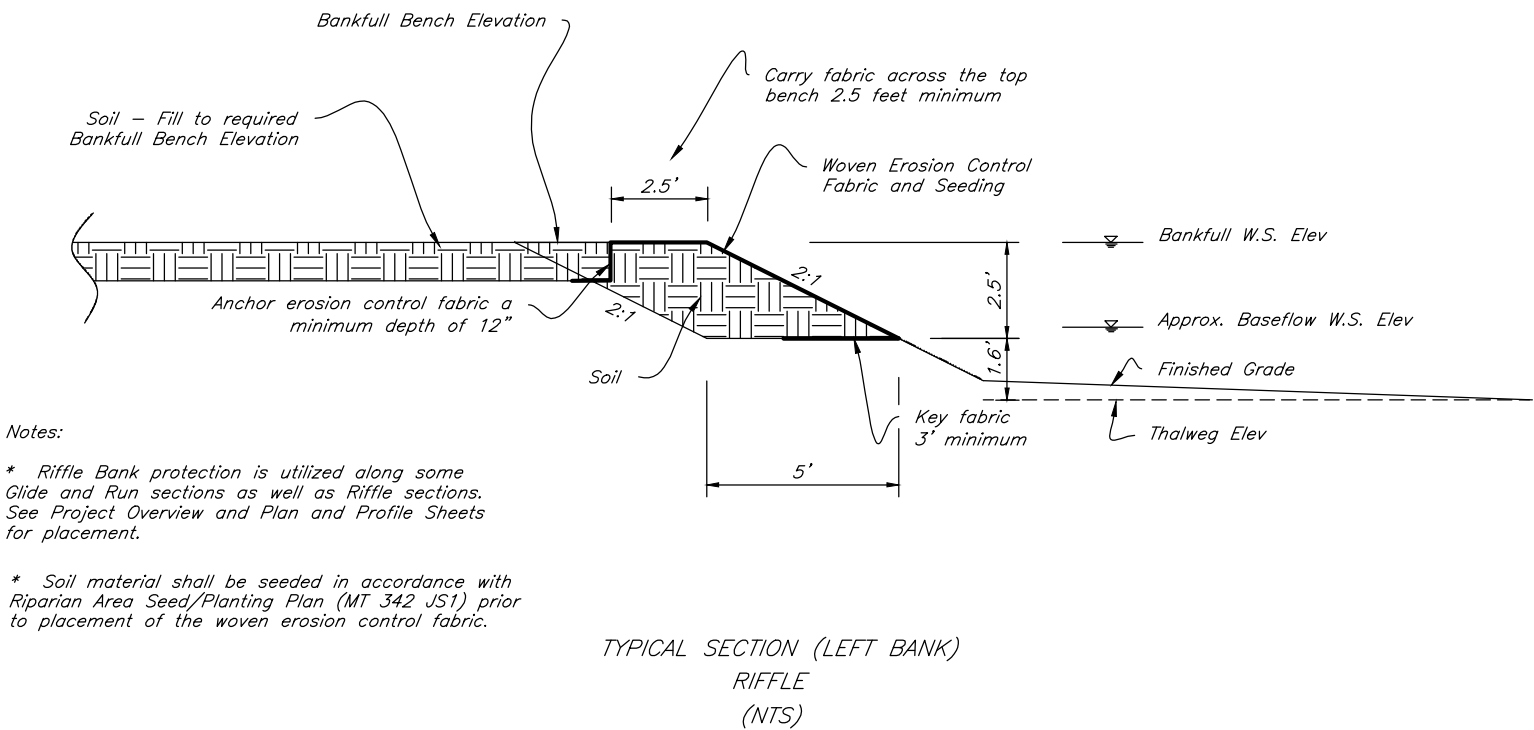
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RIFFLE BANK PROTECTION REACH LOCATION	
DNSTREAM CL STA.*	UPSTREAM CL STA.*
102+25 R	102+75 R
103+95 R	104+43 R
104+24 L	104+65 L
105+70 L	105+87 L
105+58 R	106+05 R
106+98 L	107+70 L
109+15 R	110+30 R
112+10 R	113+10 R
112+10 L	112+80 L
114+83 L	116+09 L
115+00 R	116+29 R
118+20 L	119+20 L
118+20 R	119+20 R
121+20 R	122+35 R
124+10 R	124+70 R
124+10 L	124+50 L
125+82 L	126+73 L
126+00 R	126+49 R
127+79 R	128+05 R
127+79 L	128+60 L
129+58 R	130+57 R
131+67 R	132+15 R
132+82 L	133+02 L

*NOTE: Bank Treatment is the same on the left and right side of the stream.





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Conservation Service

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BANK PROTECTION DETAILS – RIFFLE
BIG SPRING CREEK RESTORATION PROJECT
MACHLER, ADAMS And MT FISH WILDLIFE & PARKS
FERGUS COUNTY
MONTANA

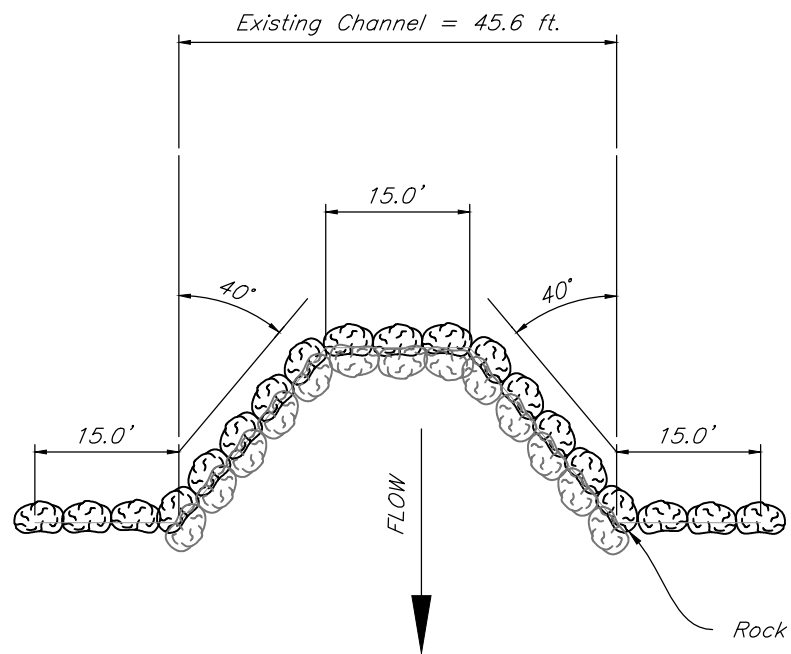
Designed
K Hoffman

Drawn
K Hoffman

Checked
S.Becker

Approved

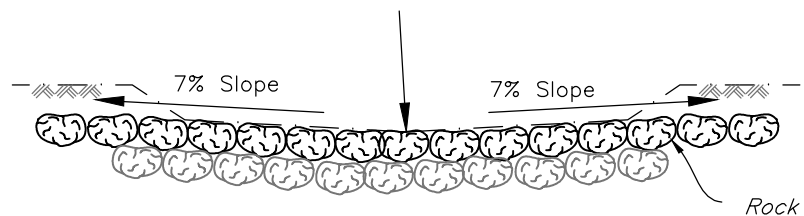
Date
7/2015
01/2015
7/15



TYPICAL CROSS-VANE PLAN VIEW

(NTS)

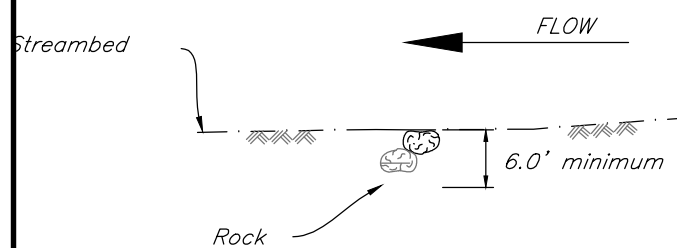
Set top of weir level with existing channel bottom at center (low point of Cross Vane)



TYPICAL CROSS-VANE ELEVATION VIEW

LOOKING DOWNSTREAM

(NTS)



TYPICAL CROSS-VANE CL PROFILE

(NTS)

CROSS VANE NOTES:

1) Boulders to be used for rock cross vanes on this project will be angular shot rock, of a generally rectangular shape. The source will be approved by the NRCS engineer prior to use as meeting project specifications.

2) Typical boulder dimensions will be approximately 5' x 3' x 3' for construction of the vane. Use a mixture of smaller sizes to fill voids between the boulders for the instream portion of the vane (no more than ~10% by volume of the structure). Smaller size rock may be used in the portion of the weir outside the constructed channel. The least dimension of any one boulder should not be less than 1/2 of the greatest dimension of the boulder. Overall requirements:

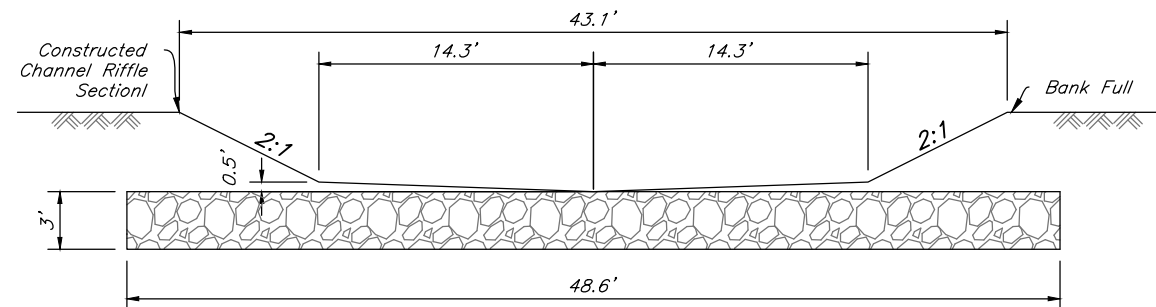
$$\begin{aligned} D_{max} &= 7.0 \text{ ft} \\ D_{50*} &= 5.0 \\ D_{min} &= 3.0 \end{aligned}$$

*to be read as: at least 50% of boulders will have one dimension of at least 5 ft.

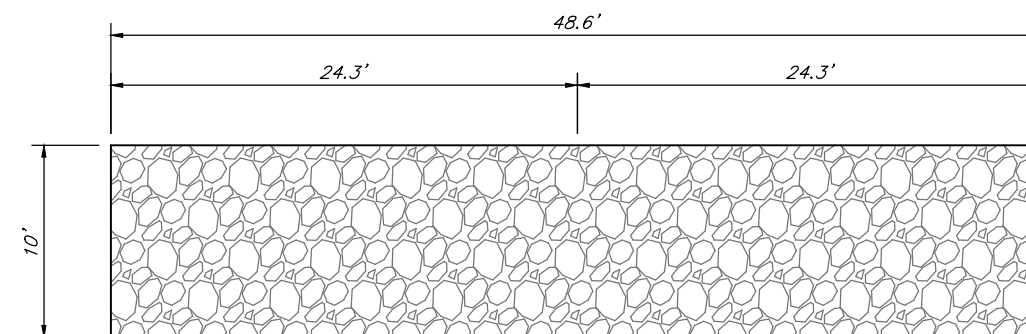
2) Vanes will be constructed with the NRCS Inspector present. Boulders will be placed by an excavator with careful attention to ensure they are stable and gaps are reduced to a minimum. Each boulder should bear against its downstream neighbor so that the force of streamflow is transferred through the weir to the bank. As each boulder is placed, give a trial push in the downstream direction to ensure it will not tip under load.

IN-STREAM STRUCTURE LOCATION CHART			
STRUCTURE	CL STN	*NORTHING ϕ	*EASTING ϕ
Rock Cross Vane Downstream	103+35	17108479.63	2029573.28
Rock Cross Vane Upstream	133+36.7	17108565.73	2031566.65

*NOTE: Easting and Northing coordinates reference the stream channel ϕ Station of the Cross Vane Structures and the center profile of the Permanent Plugs on the right bank (looking downstream).

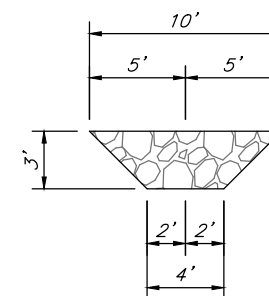


TYPICAL COBBLE PATCH STRUCTURE PLAN VIEW



TYPICAL COBBLE PATCH STRUCTURE PLAN VIEW

GRADATION COBBLE PATCH ROCK



Size	% Passing
12"	100%
9"	60-100
6"	35-50
3"	10-35
1.5"	0-25

TYPICAL COBBLE PATCH STRUCTURE PLAN VIEW

COBBLE PATCH LOCATIONS			
Number	ϕ Station	Number	ϕ Station
1	102+25	8	118+19
2	103+95	9	121+20
3	105+05	10	124+10
4	107+10	11	125+99.5
5	109+15	12	127+79
6	112+10	13	129+80
7	115+00		

Date	7/2015
Designed	K Hoffman
Drawn	D Baker
Checked	S.Becker
Approved	

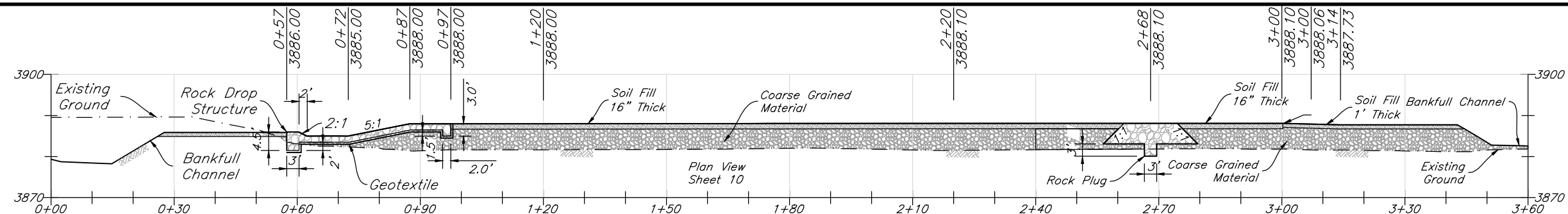
IN-STREAM STRUCTURE DETAILS
BIG SPRING CREEK RESTORATION PROJECT
MACHLER, ADAMS And MT FISH WILDLIFE & PARKS
FERGUS COUNTY MONTANA

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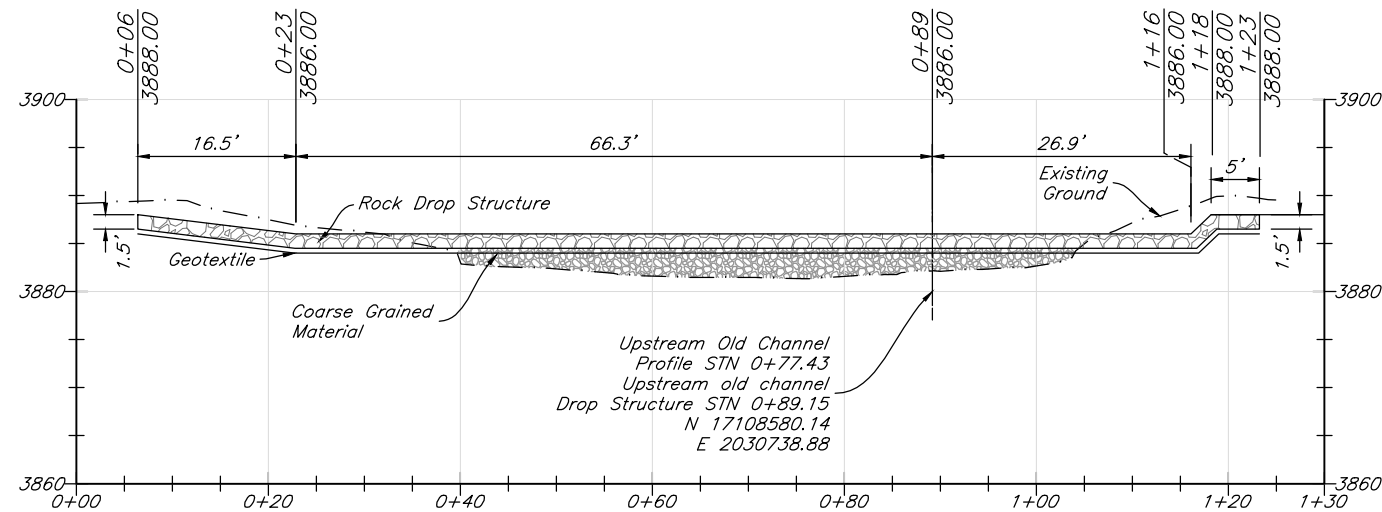
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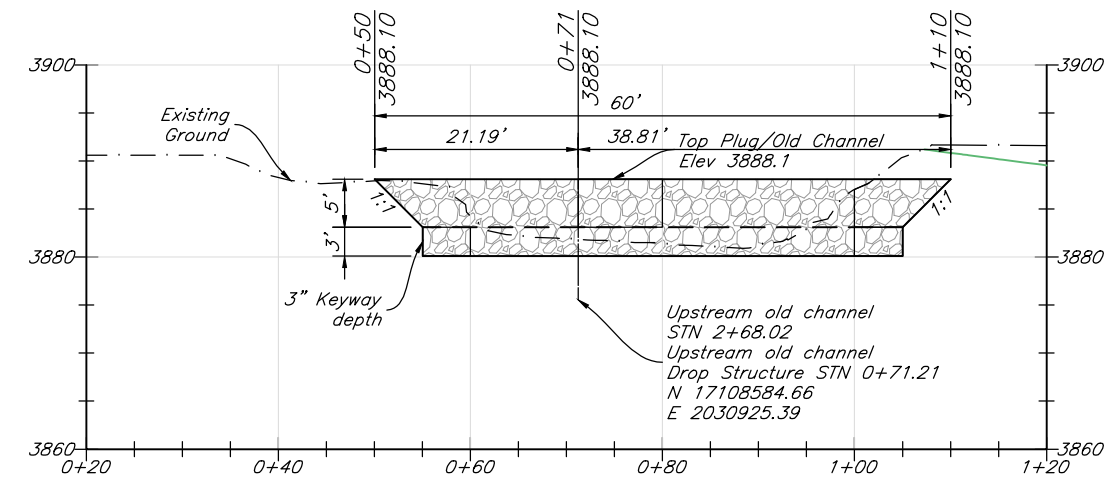
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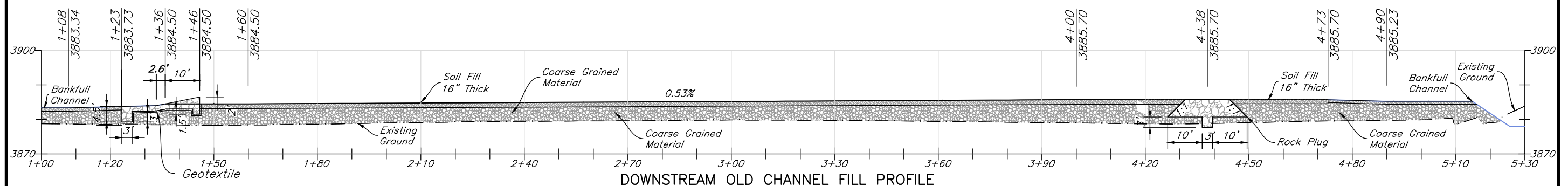
UPSTREAM OLD CHANNEL FILL PROFILE



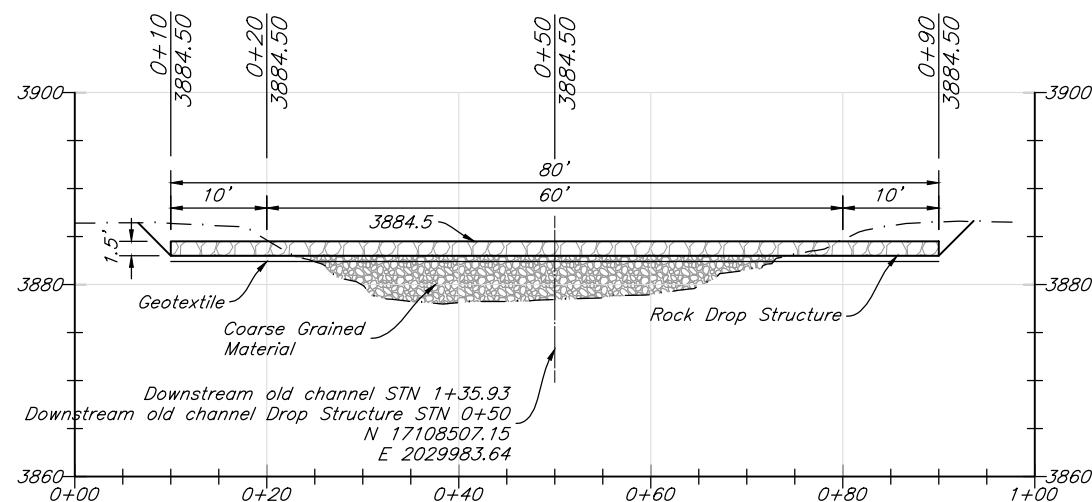
UPSTREAM OLD CHANNEL ROCK DROP STRUCTURE PROFILE



UPSTREAM OLD CHANNEL ROCK PLUG PROFILE



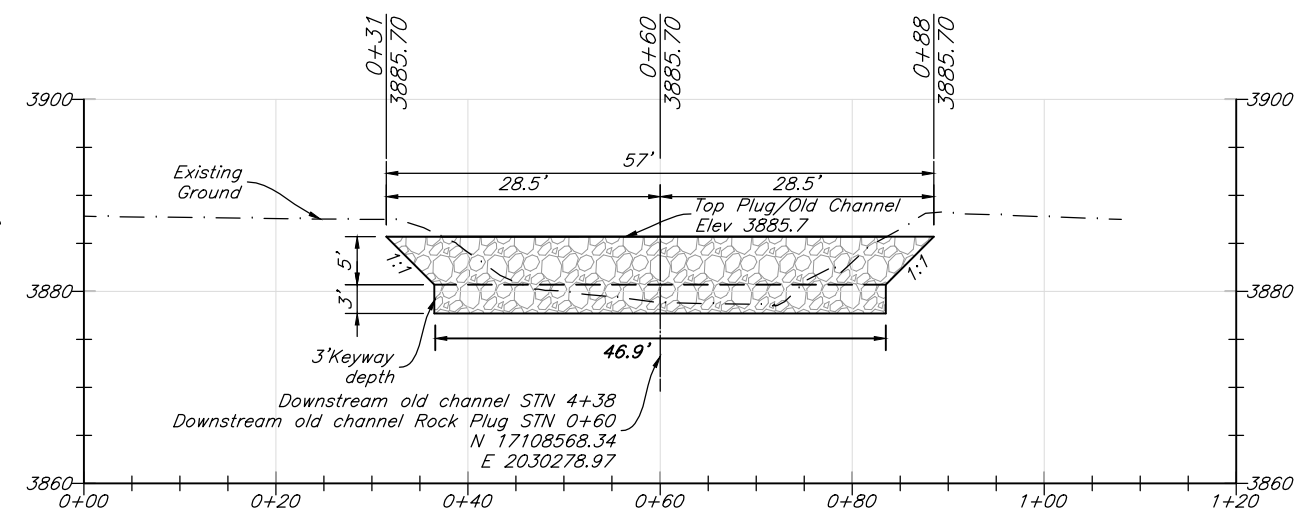
DOWNSTREAM OLD CHANNEL FILL PROFILE



DOWNSTREAM OLD CHANNEL ROCK DROP STRUCTURE PROFILE

PERMANENT DROP STRUCTURE & PLUG NOTES:

- 1) Riprap to be used for construction of the permanent rock plugs and drop structures in the old stream channel will be angular shot rock. The source will be approved by the NRCS engineer prior to use as meeting project specifications.
- 2) The drop structures and plugs will be constructed with the NRCS Inspector present. See construction specifications for rock gradation and additional requirements.
- 3) Rock Plugs shall be enveloped with 2 feet minimum, coarse granular material.



DOWNSTREAM OLD CHANNEL ROCK PLUG PROFILE

Date	7/2015
Designed	K Hoffman
Drawn	B Krueger
Checked	S Becker
Approved	

OLD CHANNEL DETAILS
BIG SPRING CREEK RESTORATION PROJECT
 MACHLER, ADAMS And MT FISH WILDLIFE & PARKS
 FERGUS COUNTY MONTANA

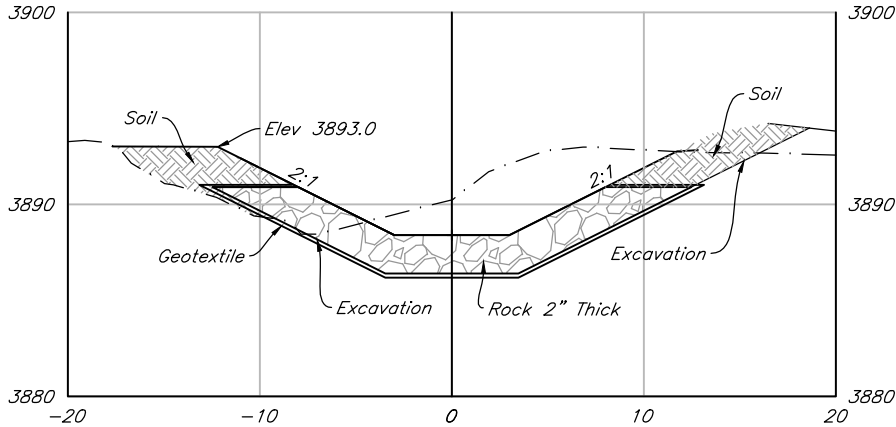
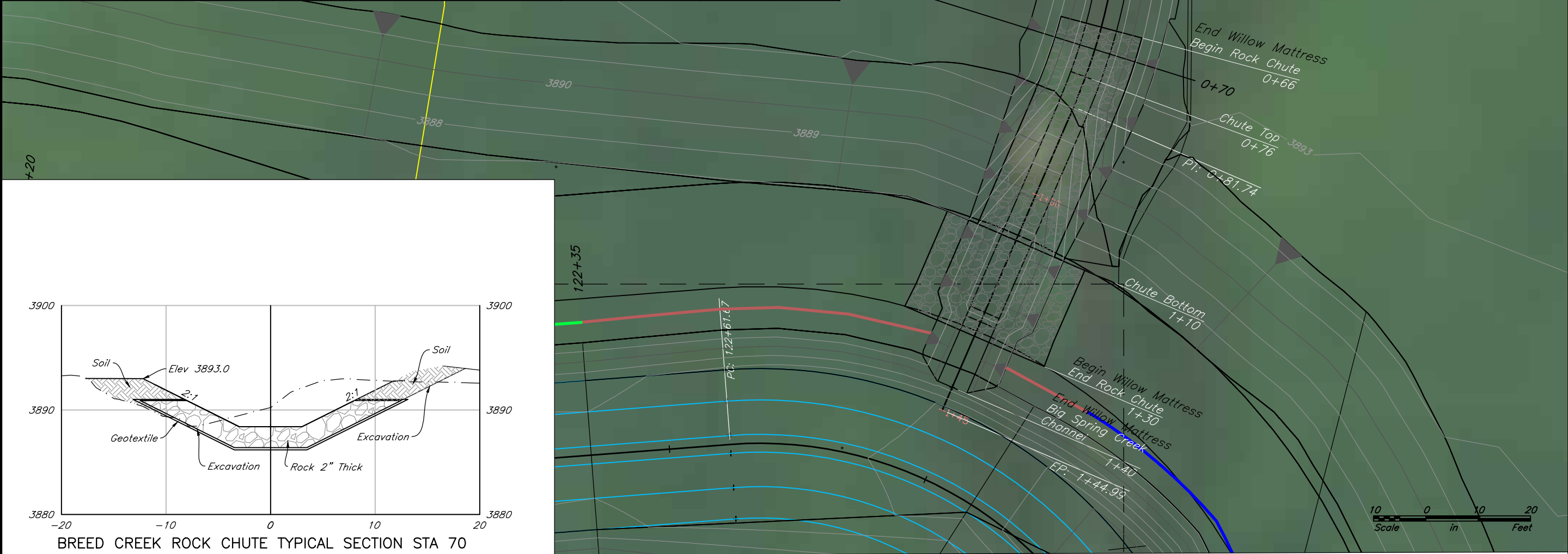


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Drawing No.
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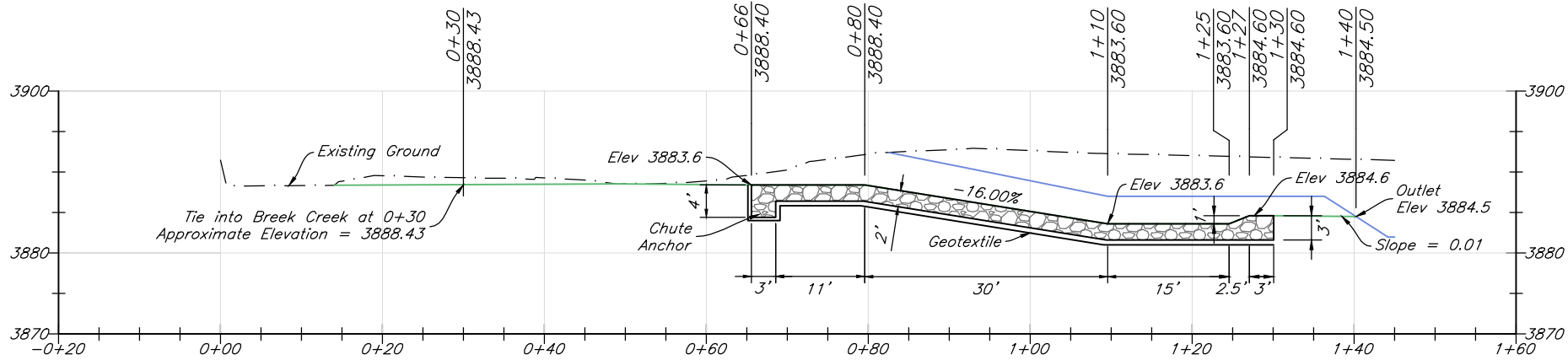
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Feature	Station	Design El.	Ground El.	Easting	Northing	L (ft)	R (ft)	Delta <	C (ft)
PI	128+54.85	3883.90	3,889.44	2030982.87	17109079.80				
PC	0+35.87	3883.91	3,889.22	2030983.17	17109044.02	45.88	110	23.8949	45.54
Rock Chute	0+65.55	3888.40	3,889.65	2030979.43	17109014.66				
Rock Chute	0+79.55	3888.40	3,891.63	2030976.40	17109005.13				
PT	0+81.74	3888.05	3,892.37	2030974.10	17108999.38				
Rock Chute	1+09.55	3883.60	3,893.78	2030963.05	17108973.87				
Rock Chute	1+29.55	3884.60	3,892.34	2030955.10	17108955.51				
Rock Chute	1+40.20	3884.50	3,891.73	2030950.86	17108945.74				



BREED CREEK ROCK CHUTE TYPICAL SECTION STA 70

PLAN VIEW



BREED CREEK ROCK CHUTE ∇ PROFILE

CHANNEL LAYOUT CHART

- "PC" = Point of Curvature
- "PT" = Point of Tangency
- "PCC" = Point of Compound Curvature
- "PRC" = Point of Reverse Curvature
- "L" = Curve Length
- "Delta <" = Angle at Curve Center Point (PC to PT)
- "R" = Curve Radius
- "C" = Chord Length
- "O" = Curve Center Point

Note:
All stationing is located along
approximate ∇ of channel.

Date	7/2015
Designed	K Hoffman
Drawn	B Krueger
Checked	S Becker
Approved	

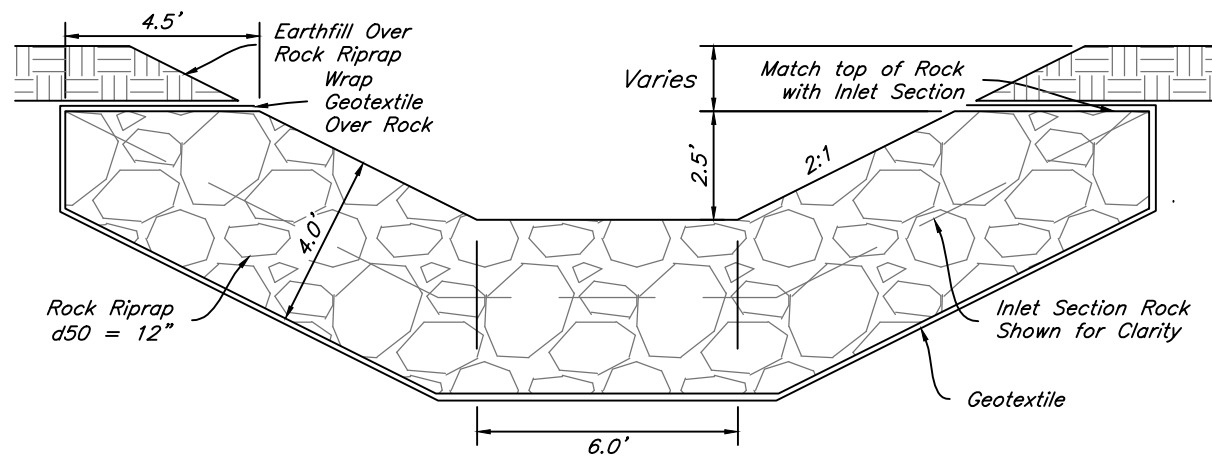
PLAN & PROFILE BREED CREEK
BIG SPRING CREEK RESTORATION PROJECT
MACHLER, ADAMS And MT FISH WILDLIFE & PARKS
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MONTANA

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Natural Resources
Conservation Service

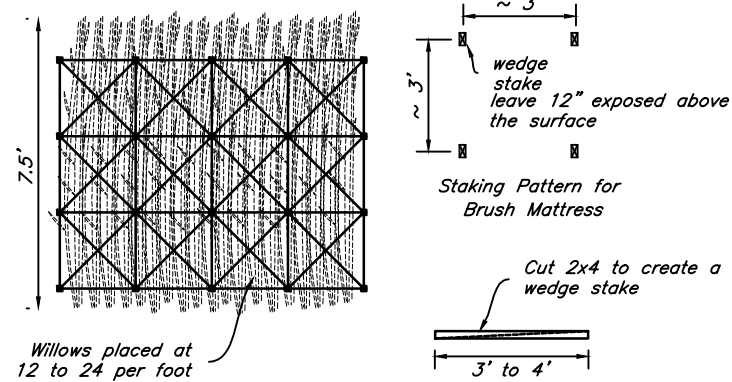
File No.
BigSpPlanPro.dwg

Drawing No.
15-31

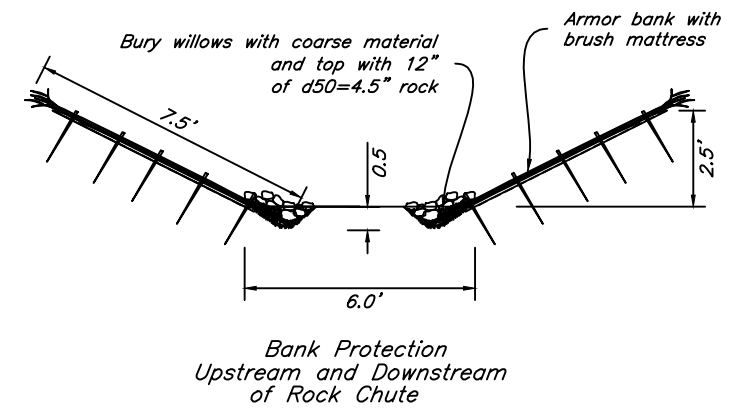
7/30/15 12:54 PM
Sheet 19 of 21



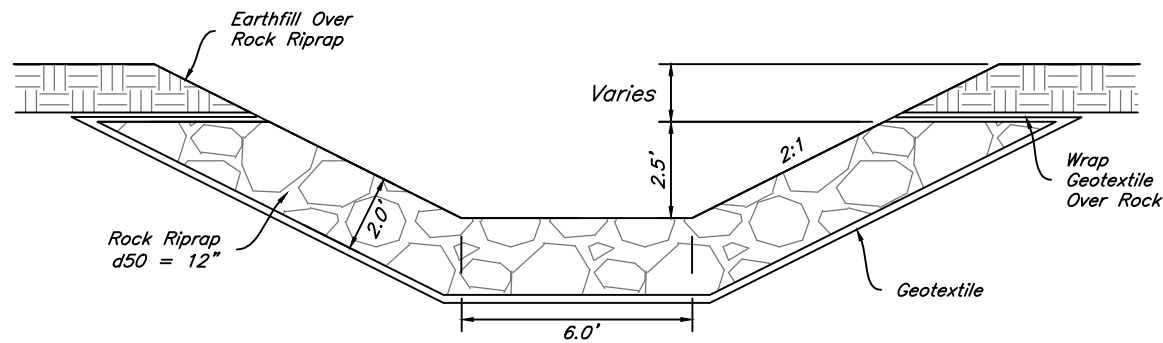
Breed Creek Rock Drop
Chute Anchor Section, Station 0+66 to 0+69



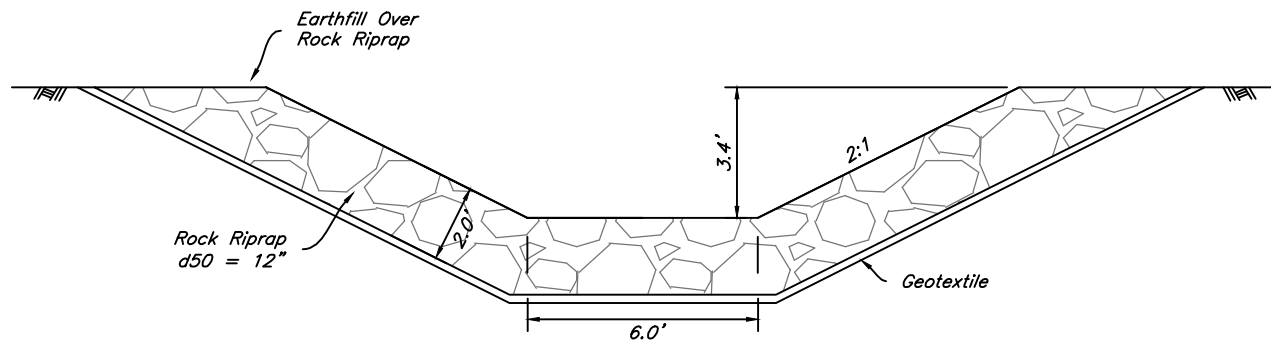
Details for Brush Mattress



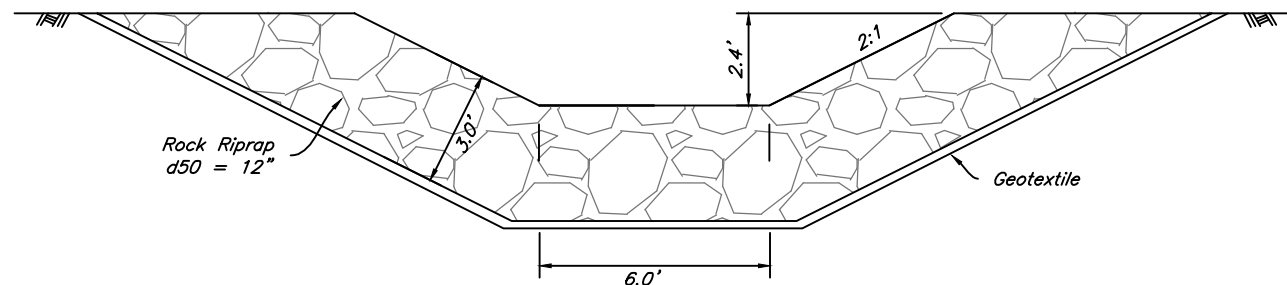
Bank Protection
Upstream and Downstream
of Rock Chute



Breed Creek Rock Drop
Inlet and Chute Section, Station 0+69 to 1+04 (Approx)



Breed Creek Rock Drop
Rock Basin Section, Station 1+10 to 1+25

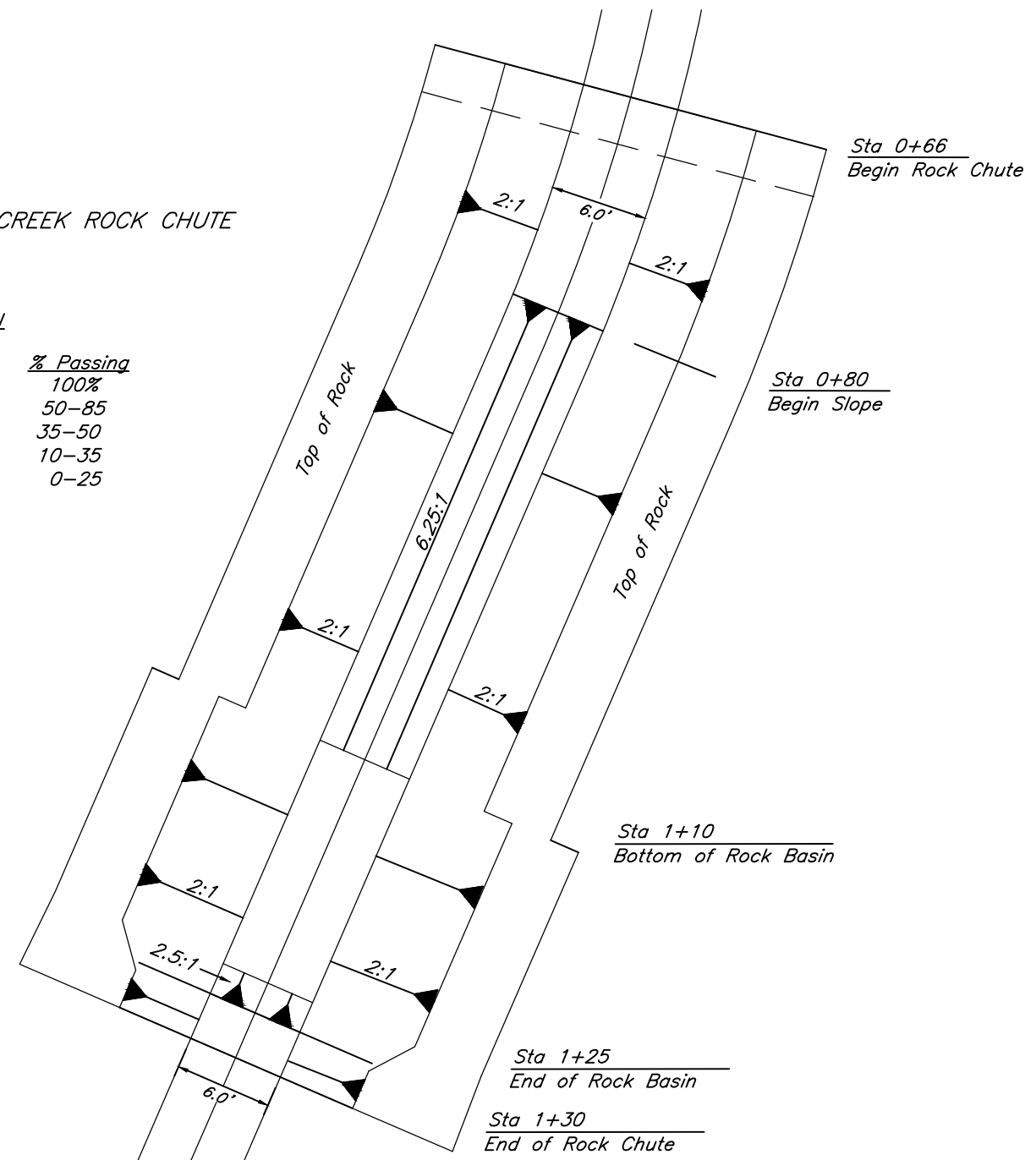


Breed Creek Rock Drop
End of Rock Basin Section, Station 1+27 to 1+30

BREED CREEK ROCK CHUTE

GRADATION

Size	% Passing
24"	100%
18"	50-85
12"	35-50
6"	10-35
3"	0-25

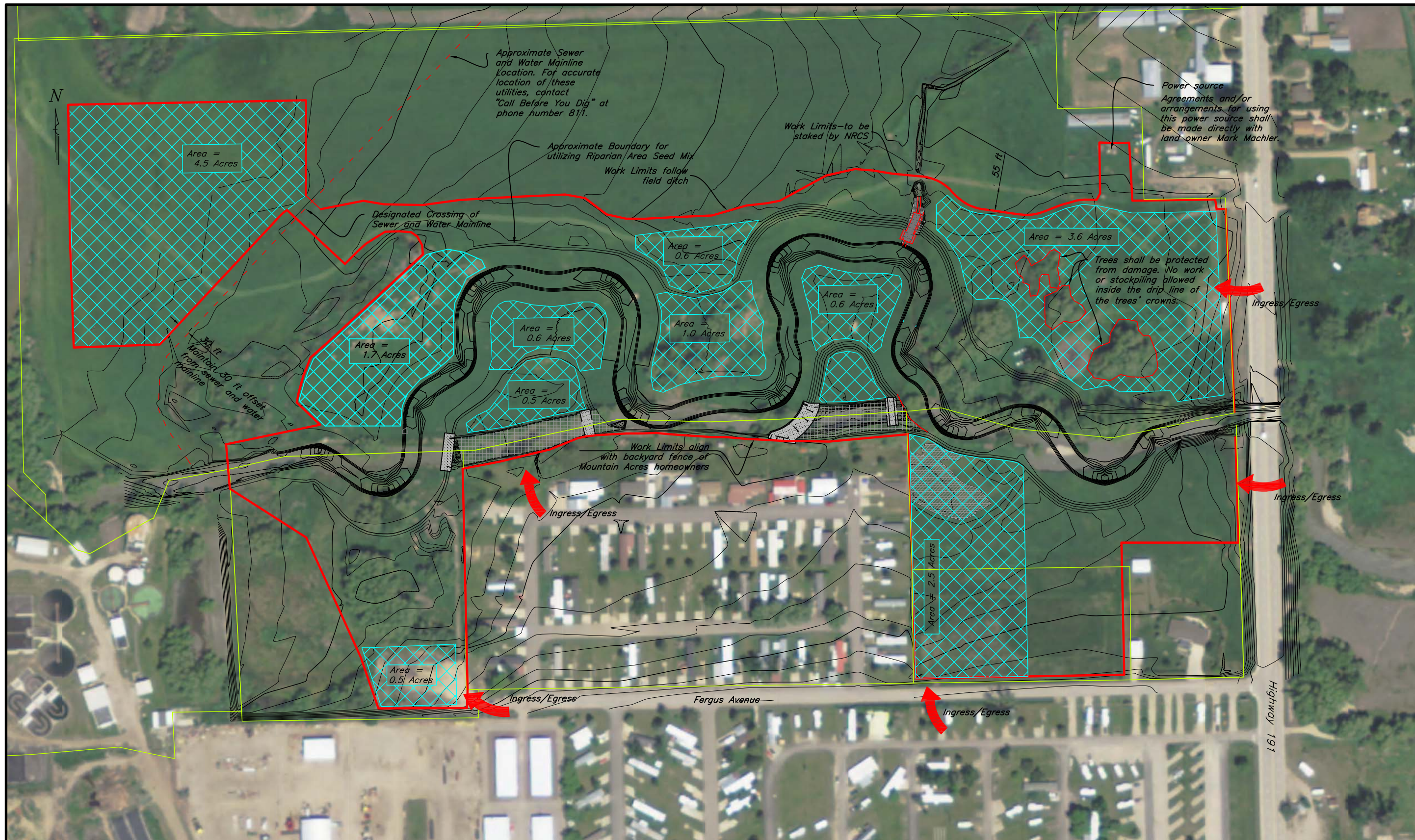


Date	7/2015
Designed	K Hoffman
Drawn	B Krueger
Checked	S Becker
Approved	

BREED CREEK ROCK CHUTE DETAILS
BIG SPRING CREEK RESTORATION PROJECT
MACHLER, ADAMS And MT FISH WILDLIFE & PARKS
FERGUS COUNTY MONTANA

United States
Department of
Agriculture
USDA
Natural Resources
Conservation Service

File No.
BigSpPlanBreed
Creek Sheet 20.dwg
Drawing No.
15-31
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- Possible Staging/Stockpile Area
- Work Limits
- Approximate Ownership Boundaries

Note: Hauling on Fergus Avenue shall be limited to earthwork and materials that originate from or are needed for construction on the south side of the existing Big Spring Creek.

PLAN VIEW CONSTRUCTION WORK LIMITS

Date	7/2015
Designed	K Hoffman
Drawn	K Hoffman
Checked	S Becker
Approved	

CONSTRUCTION WORK LIMITS
 BIG SPRING CREEK RESTORATION PROJECT
 MACHLER, ADAMS And MT FISH WILDLIFE & PARKS
 FERGUS COUNTY MONTANA

United States Department of Agriculture USDA Natural Resources Conservation Service	File No. BigSpWORKLIMITS.dwg Drawing No. 15-31 7/28/15 6:14 PM Sheet 21 of 21
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